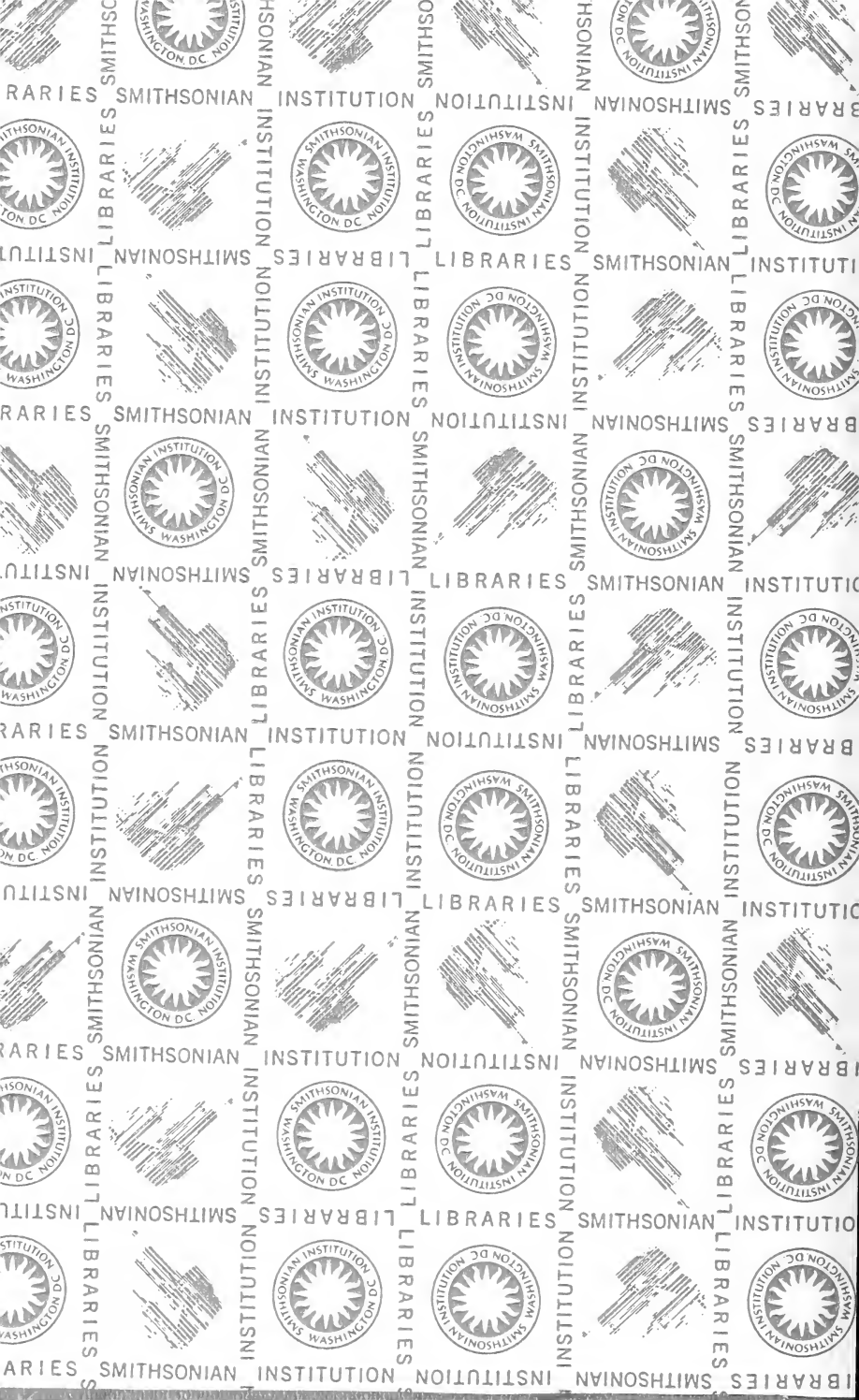


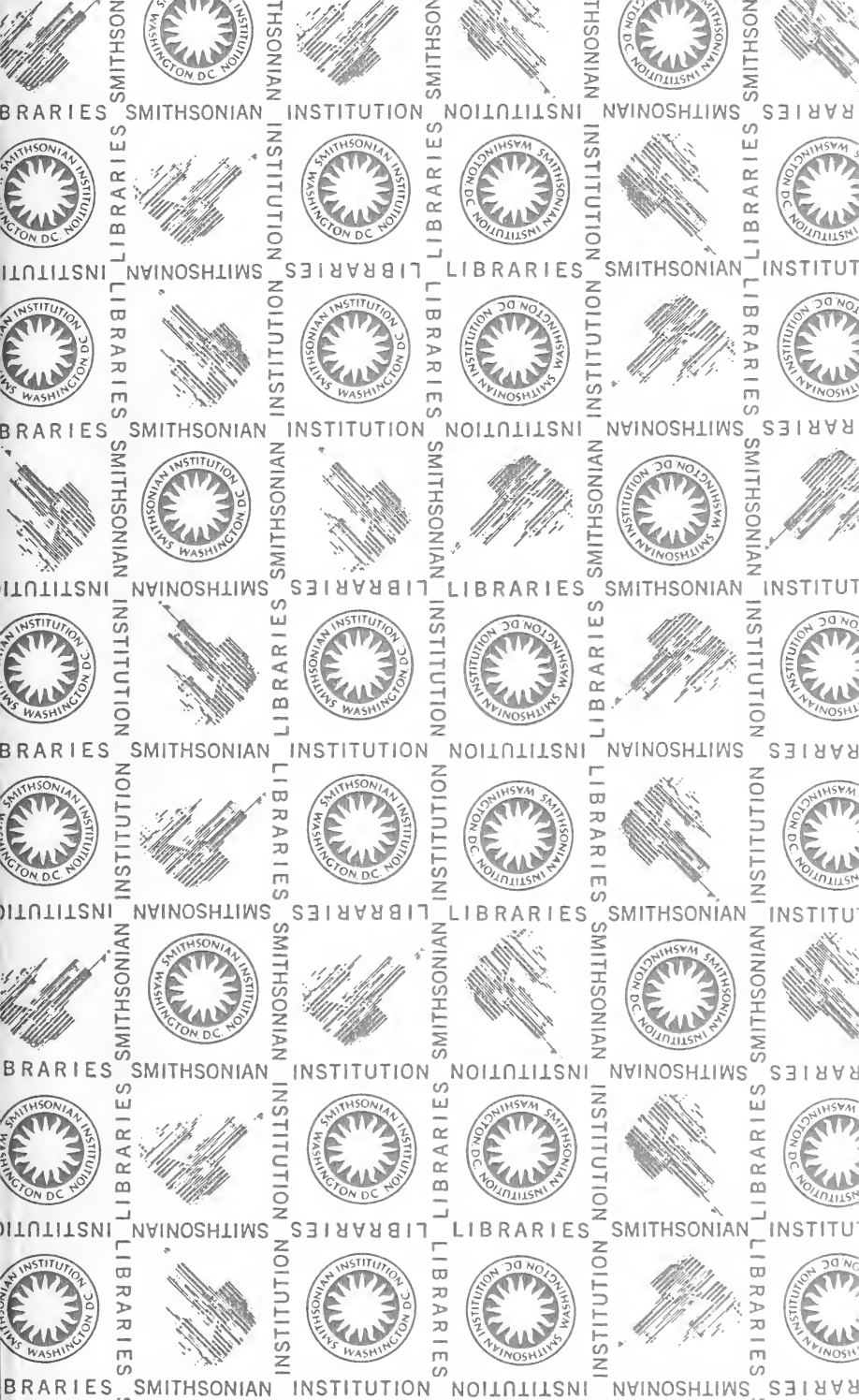
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REPORT

ON THE

SURVEYS

OF THE

Allegheny Valley Rail Road:

READ BEFORE THE

PRESIDENT AND BOARD,

JULY 26, 1853.

BY

W. MILNOR ROBERTS,

CHIEF ENGINEER.



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PITTSBURGH:

PRINTED BY W. S. HAVEN, CORNER OF MARKET AND SECOND STREETS
1853.

1853.

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OF THE
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REPORT.

To Hon. WM. F. JOHNSTON,

PRESIDENT OF THE ALLEGHENY VALLEY RAIL ROAD.

SIR—I have the honor to present the following Report on the surveys made for the Allegheny Valley Rail Road, between Kittanning and the New York State line, together with the accompanying Maps, Profiles, and Records; to which it is proposed to refer at this time, chiefly in an engineering point of view.

These surveys were conducted by Robert W. Clarke and J. S. Lawrence, in 1852, and by Mr. Clarke, Franklin Wright, and Charles M. Boyle, during the present season, under the supervision of George R. Eichbaum, Associate Engineer, and myself. They are very extensive, covering a large scope of country, and exhibiting a vast amount of topographical information, which, when fully and carefully collated and condensed, must give them great public value. A simple enumeration, in this place, of all the lines traced would occupy considerable space, without conveying adequate practical information; they can only be profitably referred to, in detail, after the main features as developed by our explorations are considered.

The proper, or most advantageous point of departure from the Allegheny river north of Kittanning, striking across the country in the direction of Olean, first occupied our attention; the great westerly bend in the river, and the increased distance along its immediate borders, forbidding the adoption of a line on its entire course, if a direct route between the proposed termini should, on examination, prove practicable. The streams on the eastern side emptying into the Allegheny, namely, the Cowanshannoc, Mahoning, Red Bank, and Clarion, which have a south-west course, and form valleys of considerable extent, were

accordingly examined first; and, at the close of last year, the main lines were traced through, except the Cowanshannoc route, which was finished during the present season, by Mr. Clarke. A trunk line was traced along the eastern side of the Allegheny as far as Catfish creek, twenty-six miles by the river survey from Kittanning, from which line all the interior routes diverge. The streams above named, as well as their principal tributaries, have been thoroughly surveyed on such parts as can be made available for the purposes in view. Towards the north-eastern terminus, in northern Pennsylvania, the surveys embrace the waters of Tunuangwant, Potato creek, Portage branch, and Upper Allegheny, running northward and uniting with the main river in M'Kean county, Pennsylvania, and Cattaraugus county, New York; and also the head waters of the Tionesta and Kenzua, tributaries running westward and emptying into the Allegheny river, above Franklin.

With the exception of one experimental line, which extended to the Portage branch of the Sinnamahoning, a tributary of the Susquehanna, the entire field of our surveys is covered by the waters of the Allegheny river. The most westerly spur of the Allegheny mountain range, called Boon's or Elk mountain, in Elk county, is a few miles eastward of our most easterly survey in that vicinity. The general course of the Allegheny river, above the mouth of the Mahoning, is in a semi-circle. It rises in Potter and M'Kean counties, Pennsylvania, runs northward to the New York State line, curves round, and enters Pennsylvania again more than thirty miles west of the point where it entered New York, flows thence south-westward to Franklin, at the mouth of French creek, (where the river is forty-five miles west of an air line drawn between the mouth of Mahoning and the most easterly crossing of the river at the State line,) and thence south-eastward to the mouth of the Mahoning. From the mouth of Mahoning to Kittanning, its course is west of south, and nearly in the direction of a straight line between our points of termination. This river holds a peculiar geographical position, and it is a striking fact, that the head-waters of its main easterly branches, the Clarion, Tionesta, and Kenzua, and its northern tributaries, the Tunuangwant, Potato creek, and Portage branch, widely as they are separated at their mouths, all take their rise in M'Kean county, within a few miles of each

other, on the same ridge or dividing ground which all the survey lines must necessarily cross.

Our surveys have developed four leading routes, passing out from the river above Kittanning toward this dividing ground, which may be designated as the

“*Cowanshannoc*,” the “*Mahoning and Red Bank*,” the “*Red Bank and Corsica*,” and the “*Clarion*” routes.

The *Cowanshannoc* route leaves the river $3\frac{1}{2}$ miles above Kittanning, at the mouth of the creek, and passes up that valley to its head, on a course a little south of east, crosses to the Mahoning waters, and runs through Punxytawney, in Jefferson county; thence along the Mahoning, and up Stump creek, and across to the waters of Sandylick; thence to Rattlesnake run, down that stream and the Little Toby to its mouth, where it intersects other routes at the Clarion river. The distance from Kittanning by the Cowanshannoc route to the mouth of Little Toby is $84\frac{1}{2}$ miles; to State line, 148 miles.

The *Mahoning and Red Bank* route follows the Allegheny river to the mouth of Mahoning, ten miles; thence up the Mahoning 8 miles; it then cuts through the dividing ground between Mahoning and Red Bank, at the Big Bend of Red Bank; thence along the Red Bank valley to its North Fork, and up the North Fork to its source at Maxwell’s summit; thence to the Clarion river, at the mouth of Little Toby, (where the Cowanshannoc line intersects,) and thence up the Clarion to *Johnsonburg*, at the junction of its east and west branches, and up the east branch to Bishop’s summit, near the town of *Teutonia*; thence down Red Mill brook to Potato creek, down Potato creek to its junction with the Allegheny, and thence to the State line. The distance from Kittanning to the mouth of Little Toby by this route is $70\frac{1}{4}$ miles, and from Kittanning to the State line, $133\frac{1}{2}$ miles, by Clarke’s location line.

Red Bank and Corsica route.—The most favorable Corsica route branches from the Mahoning and Red Bank route 23 miles from Kittanning, at New Bethlehem, near the mouth of Leasure’s run, passing up that stream to its head, and across the summit dividing the waters of Leasure’s run and Little Piney, a branch of the Clarion; thence up the Little Piney to the summit near Corsica, and along the dividing ridge between the

waters of Clarion and Red Bank to its intersection with the "Mahoning and Red Bank" route, about 5 miles above Brookville. The distance from Kittanning to the intersection is $63\frac{1}{4}$ miles; to State line, $135\frac{1}{2}$ miles.

The *Clarion route* follows the east side of the Allegheny river, crossing the Mahoning and Red Bank, and passes through the neck of *Brady's Bend* and across to Catfish creek; thence up Catfish to Steele's summit, down Cherry run and Licking creek to the Clarion river, at Callensburg; thence up the Clarion to the mouth of Deer creek, and up Deer and Paint creeks, by Shippenville, to the summit between the waters of Tionesta and Clarion, near Tylersburg; thence through Blood's and Elletthorpe's settlements, along the dividing ground between the waters of Clarion, Tionesta, and Kenzua, to the main summit near M'Falls, near the great bend of Kenzua, and thence down Cole's creek and down Potato creek to the Allegheny river, and along the valley of that stream to the State line. The distance from Kittanning to the State line is $140\frac{1}{8}$ miles.

In addition to these routes there are numerous alternate lines, to which reference will be made more particularly, in connexion with the leading routes to which they respectively appertain. It was deemed most convenient to present at one view the general route of the principal or trunk lines, without embarrassing the description too much with details.

Of the "Cowanshannoc" lines.

The distance on the route previously described is taken from the line traced along the Allegheny river to the mouth of the Cowanshannoc, and thence out through the valley. An alternate, or cut-off line was traced, tunneling the river hill near Kittanning, and thence into the same valley. Although this cut-off saves five miles, it encounters a tunnel 6,300 feet in length, on our maximum grade, with very deep cuts at the ends. It has therefore been abandoned as impracticable. The first seventeen miles of the Cowanshannoc route pass over very favorable ground, where a Rail Road with easy grades can be made at little cost. The residue of the line encounters a large amount of heavy work, and a considerable portion of maximum grades and hard curves. At the distance of eighty-four miles from Kittanning it falls into the "Mahoning and Red Bank" line, and

is in common with it thence to the State line. The additional distance, as compared with that line, is so great, being fourteen miles on a length of seventy miles, that it would require a very considerable saving in cost, and an advantage in some other respects, which our examinations have not yet shown, to induce its recommendation, in an engineering point of view, in preference to shorter lines.

Of the "Mahoning and Red Bank" lines.

The line described is on the route traced last season by Mr. Clarke. Additional surveys have been made this year on the southern end, by Mr. Clarke and Mr. Wright, and on the northern end by Mr. Boyle, to ascertain whether any material improvements in the location were practicable. On the southern end a cut-off line was run, commencing at Pine creek, and intersecting the original line at the distance of $10\frac{7}{10}$ miles. It saves two miles of distance, but encounters more rise and fall, more curvature, twenty-four hundred and ten feet more tunneling, twenty-one hundred feet more bridging, of the most expensive character, and a large amount of heavy cutting and filling, increasing the estimated cost, at the present contract prices, \$490,000. Its adoption cannot, therefore, be recommended. No route has yet been found between the Mahoning and Red Bank superior to the line already described, passing, by a tunnel, through Lavelly's summit. At the northern end of the Mahoning and Red Bank route, between the State line and the main dividing ridge before alluded to, an extensive series of additional surveys has been made during the present season, the field notes, maps, and profiles of which are herewith exhibited. I spent some time in personal examinations of these routes, and, from all the information gathered, it is evident that the preferred route of Mr. Clarke, passing from Bishop's summit down the valleys of Red Mill brook and Potato creek, is in the most advantageous valleys between Bishop's summit and the State line. Several lines have been run with the view of shortening the proposed connexion between your road and the Corning and Olean line, cutting through the ridge which divides the waters of the Allegheny from those of the Oswaya, one of its main branches, passing up Anin creek, Newell brook, and Cook's run, on three different routes from the valley of the Allegheny, and

thence into the valley of Bell's run, which empties into the Oswaya one and a half miles east of the village of Ceres. These routes are all more expensive, though shorter, than the route following the main Allegheny.

A line was also run up the Portage branch of the Allegheny, to test the practicability of a route farther eastward than any of the surveys of 1852. There is no material difficulty in attaining the summit from the *north* to connect with the waters of the Sinnamahoning, but the route is exceedingly unfavorable on the southern side, and would add greatly to the length and cost of the road. On this account the surveys in that direction were stopped in May last.

A line was traced up the Ginalsburgh fork of the east branch of the Clarion, to test the practicability of improving the route by passing west of Bishop's summit across to the waters of Marvin creek, which shows that the distance would be increased, without compensating advantages in other respects. The waters of the Tionesta and Kenzua interlock, or pass by, the waters of Marvin creek, and the gorges of those streams near their heads, especially the *Kenzua*, are so deep and precipitous as to force any feasible line upon a very circuitous route. Lines coming up from the south cannot be constructed *across* these gorges except at enormous cost, and they must necessarily be thrown around near the head springs on the crest of the ridge, and even after entering Marvin creek it is found to present a more crooked and costly route than the line down Red Mill brook.

An examination was also made down the *right* bank of Red Mill brook to near its mouth, thence up the Potato creek (on a descending grade) for about one mile, thence across that valley and down the east side of Potato creek. It increased the distance four miles, without any saving in cost, grades, or curvature.

A carefully revised line has been run from a point one and a half miles south of the State line, up the Allegheny valley and Potato creek to the vicinity of Smethport, a map and profile of which are herewith shown. The party is still engaged in extending it along Potato creek and up the left bank of Red Mill brook, on the general route traced last season. In view of a heavy, preponderating trade northward, springing from the great coal region near and south of Bishop's summit, this part

of the line has been arranged without any grades ascending towards the State line; and, so far as it has been traced, (about seventeen miles,) it proves to be a cheap and advantageous line. The importance of this arrangement of the grades will be appreciated by those who are familiar with large coal operations.

Of the "Corsica" routes.

In addition to the routes examined last year, along the Leatherwood, Leasure's run, and Hunter's run, a number of lines have been surveyed during the present season, by Mr. Wright, partly in connexion with the Corsica lines, and partly appertaining to the Clarion lines.

The *Reimersburg* line commences at the American Furnace, on the Allegheny river, five miles above the mouth of Mahoning, and rising at the maximum grade of $52\frac{8}{16}$ feet per mile, follows the general course of the river, along the face of a very steep side hill, for about three miles. It then inclines to the east, and passes through the point of hill between the Allegheny river and Red Bank, with a cut eighty-two feet in depth at the summit; thence to Red Bank directly opposite the mouth of Hunter's run, crossing Red Bank at that point with a bridge twelve hundred feet long, and two hundred and thirty-four feet above the surface of the water. The line, maintaining the same grade, passes up the valley of Hunter's run to the head of its west fork; thence by a tunnel fifteen hundred feet long, at Martin's summit, into the valley of Turkey run, and through the point of hill between two branches of Turkey run, by a tunnel four hundred feet long, continuing up that valley to its head; thence the line passes to the valley of the west fork of Fiddler's run, by a tunnel twenty-three hundred feet long, at Lobaugh's summit, and up the valley of that stream to the summit of the ridge dividing the waters of Clarion and Red Bank, near Reimersburg, called Benn's summit, at which point the grade line is five hundred and fifty feet higher than at the American Furnace; thence the line lies on or near the top of the ridge between Clarion and Red Bank, to the head of Leatherwood creek, where it intersects the Corsica route surveyed last year. The distance by this route to the common point of junction is eight and a half miles longer than the Mahoning and Red Bank route. It is much more costly, has more ascent and descent,

more maximum grade, and more curvature. It is 52.09 miles by this route from Kittanning to the junction above Brookville.

The *Leatherwood* route, with the limit of grade adopted, $52\frac{8}{10}$ feet per mile, cannot pass along the bottom of the valley from its mouth, nor even with a high starting point at the mouth of the creek can it pass from the Leatherwood valley to the Piney waters without encountering a tunnel at Sloan's summit 1100 feet long, with heavy deep cuts at the ends. The only feasible mode of entering the valley of Leatherwood near its mouth, with the limit of grade named, is by a route passing up the Allegheny river to the mouth of Red Bank, and thence up that stream, which makes it $12\frac{77}{100}$ miles longer than the Mahoning and Red Bank route. There is a much shorter cut-off line to the Leatherwood valley, branching from the Mahoning and Red Bank line on Reedy run, running thence directly to the mouth of Leatherwood creek; but it involves a tunnel nearly a mile in length, and a very long high bridge across the Red Bank. This would intersect the first route at the head of Leatherwood. After leaving the head of that stream, by the tunnel and deep cuts, these lines united would encounter a tunnel on the dividing ridge between Big and Little Piney, 1150 feet long, at Orkett's Gap, with deep cuts, and a very long heavy cut some distance beyond; so that the Leatherwood route, to the common point of junction above Brookville, is longer, more costly, has more rise and fall, more maximum grade, and more curvature than the Mahoning and Red Bank route.

The most advantageous route amongst the Corsica lines is that which branches from the Mahoning and Red Bank route at New Bethlehem, near the mouth of Leasure's run.

Leasure's Run Route.—The valley of Leasure's run, like that of Leatherwood, is favorable for the construction of a Rail Road, provided higher grades than our assumed limit could be adopted on the upper part. It is impracticable, with that limit, to run up the bottom of Leasure's run and pass the summit between the waters of Leasure's run and Piney. The only mode, with the grade of $52\frac{8}{10}$ feet per mile, would be to take a higher elevation on the side hill near its mouth, which would cause a costly crossing of Red Bank, near New Bethlehem, and continue it along the side hill, in heavy cutting and filling, till it approached the head of the valley, thus adding greatly to the

cost and curvature. Even then, it would require a tunnel 550 feet long at the summit, with heavy deep cuts. This line is much preferable to the Leatherwood route in attaining the summit near Sloan's. Beyond that point it is common with it, and meets the same difficulties between Big and Little Piney, &c. It is two miles longer than the Mahoning and Red Bank route, and inferior to it in all the essential features of cost, grade, and curvature. The distance by this route from Kittanning to the State line is $135\frac{1}{2}$ miles.

It may be remarked, that a line from Kittanning, if regarded as on the proper ground when in the valley of Red Bank, at New Bethlehem, should unquestionably continue in that valley, unless some material advantage in distance, grade, curvature, or cost, could be gained by leaving it. The surveys show, that all these advantages are on the route directly up the main valley of Red Bank.

Of the "Clarion" routes.

The Callensburg route diverges from the Mahoning and Red Bank route at the mouth of the Mahoning, 10 miles above Kittanning, and continues along the Allegheny river to Red Bank, which is crossed at its mouth. The line thence passes up the Allegheny, and through the neck of Brady's bend by a tunnel, and up the valley of Catfish run, on an ascending grade of $52\frac{8}{10}$ feet per mile for $7\frac{1}{2}$ miles, to Steele's summit. The bridge across the mouth of Red Bank would be 1000 feet long and 154 feet above the bed of the stream. There would be a tunnel at Brady's bend of 1300 feet, and one at Steele's summit 1100 feet in length. Expensive graduation occurs in passing from the river into the valley of Catfish. From Steele's summit the line descends along the Cherry run and Licking to Clarion river, near Callensburg, and thence up the Clarion to Deer creek, which is ascended to Paint creek, along the valley of which it ascends to the top of the ridge between Paint and Tionesta creeks, near Tylersburg, $57\frac{1}{2}$ miles from Kittanning. A line was traced passing round Brady's bend by the river valley, which increased the distance nearly five miles.

Another line was surveyed from Steele's summit, passing across the valley of Cherry run into that of Licking, and across Licking, below Sligo Furnace, and up the valley of Anderson's run to Beck's summit; thence down Beck's run to Piney, which

is crossed below Madison Furnace, and passing thence up Piney and a branch of Brush run, and through to the valley of the Clarion river. After passing the borough of Clarion, the line continued in the river valley up to the mouth of Toby, (North Toby,) and up that stream to the point of intersection of the first line, near Tylersburg. This line is more undulating, and would have more maximum grade than the Callensburg and Paint creek line. The graduation on the Sligo and Toby route would be more expensive than on the Paint creek line, but the distance would be $1\frac{1}{2}$ miles shorter.

From the point near Tylersburg, the line of survey passes along the dividing ground between the Clarion and Tionesta waters, to Blood's settlement, in Forest county, $70\frac{1}{2}$ miles from Kittanning, and thence along the same ridge to Ellethorpe's. From Ellethorpe's it passes along between the Clarion and Kenzua waters to a point near M'Falls, near the head of the west branch of Marvin, which runs into Potato creek near Smethport. From Kittanning to M'Falls the distance is $116\frac{1}{2}$ miles. The surface is gently undulating and favorable for graduation on the dividing ground, requiring but few culverts or bridges of any magnitude. From M'Falls summit to the New York State line there were three lines traced—the Marvin creek, Cole's creek, and Tunuangwant routes. It requires a tunnel 4000 feet in length to pass into Marvin creek, and its rapid descent, and abrupt curvature, occasioned by numerous large ravines, render this route very costly and objectionable. The Cole's creek line passes northward near M'Falls, along the eastern verge of the big bend of Kenzua, and thence over to Cole's creek, down that stream to Potato creek, and thence, by Potato creek and Allegheny river, to the State line. A grade of 70 feet per mile was found necessary in going down Cole's creek, which passes over many deep ravines, requiring a large amount of abrupt curvature and heavy filling. The main ridge maintains its height so far northward on this route that it deprives us of the opportunity of reducing it essentially by tunneling, except by a tunnel of such length as would be entirely inadmissible; so that the grade of 70 feet per mile stands as an unavoidable obstacle on this route, even on a very expensive line.

The Tunuangwant line diverges from the Cole's creek line at Station 146 of V² line, northward of M'Falls, and after passing

across Black creek and Three-Mile run—waters of the Kenzua, passes to the head waters of the main east branch of Tunuangwant, north-east from Lafayette corners, and thence descending along the valley of Tunuangwant, passes the villages of Littleton and Tarport, to the State line, $14\frac{1}{4}$ miles westward of the crossing of the Allegheny river. The mouth of Tunuangwant is about 6 miles north of the State line, and about 10 miles, on an air line, west of Olean. From the Tunuangwant crossing of the State line to Olean, the Rail Road distance would be about $15\frac{1}{4}$ miles. From the Allegheny crossing to Olean, the Rail Road distance would be about $9\frac{1}{4}$ miles. Difference, 6 miles.

The rapid fall of the upper part of the Tunuangwant, joined to the northward projection of the great dividing ridge before mentioned, forces the line to encounter the numerous ravines occurring, high up on the side hill, occasioning costly work, and requiring, in order to reach the valley at the State line, a grade of 70 feet per mile. The distance from Kittanning to the State line, in the Tunuangwant valley, as traced along the bottom of the valley, is 136 miles. On a located line along the side hill, curving into the side valleys to reduce the heavy fills, this distance would necessarily be considerably increased.

It thus appears that the chief difficulties on the Clarion routes occur towards the northern and southern extremities of the surveys, within twenty miles of the State line, and within the same distance of the mouth of Mahoning.

In order to test fully the Rail Road capabilities of the country generally, extensive additional surveys were made this year, by Mr. Wright, on the southern, and Mr. Boyle, on the northern end. There has not been time since the completion of these surveys to condense in minute detail all the information acquired, but the main features of all the alternate lines may be understood by comparing the several maps and profiles; and the Board can determine whether further examination, or more particular calculations, are now necessary.

The estimated cost of the Clarion route, presented in February, was made out on the line traced down Cole's creek, on a grade of 70 feet per mile. The cost, down either Tunuangwant, Cole's creek, or Marvin, taking any route yet surveyed through Clarion county, would not be less than that estimate, if we adhere to our maximum of $52\frac{8}{10}$ feet per mile.

The following are the lengths of several alternate lines traced through Clarion county, assuming the common starting point, at Kittanning:

Leatherwood Route, MILES.

Via mouth of Red Bank, mouth of Leatherwood, and
Sloan's summit, to Corsica, distance 52.09

Leasure's Run Route,

Via mouth of Mahoning to Reedy Run, through ridge to
Red Bank, and up valley of Leasure's run to Corsica, 38.25

Reimersburg Route,

Via American Furnace, high crossing of Red Bank,
Hunter's run, and Benn's, Hoover's, and Sloan's sum-
mits, to Corsica 46.48

Strattonville Route,

Via American Furnace to Benn's summit, and passing
east of Strattonville to Corsica 46.32

Greenville Route,

Via American Furnace to Benn's summit, through
Greenville, to Corsica 44.47

ALSO,

Callansburg Route,

Via American Furnace, Benn's summit, and Canoe
creek, to junction of Paint creek and Toby lines . 62.05

Original Route,

From Kittanning to same point, by Mr. Lawrence's sur-
vey of 1852 59.33

Brush Run Route,

Via American Furnace, Benn's summit, point near Brush
run, to junction of Paint creek and Toby lines . 55.60

The Brush run route, which is $3\frac{3}{4}$ miles shorter than the survey of 1852, encounters the steep side hill above the American Furnace, and the high and almost impracticable crossing of Red Bank, at the mouth of Hunter's Run, the tunnels at Martin's and Benn's summits, with maximum undulating grades, and ex-

pensive cutting and filling on the route through Clarion county, and, with our limit of grade, is much more costly than the route by Catfish; and, being in common with it from the junction of Paint creek and Little Toby lines, meets the same difficulties at the Northern end of the route on the main dividing ridge.

The other alternate lines running to the intersection with the Mahoning and Red Bank lines, are all longer, with more ascent and descent, more curvature and with more costly work per mile, than the Mahoning and Red Bank line.

The difference in the estimated cost of construction between the Clarion route and the Mahoning and Red Bank route, \$990, 167, will not be materially changed by the introduction of any alternate lines through Clarion County; whilst the impediments before described must be common to all, except those which return again to the Mahoning and Red Bank line, and the shortest of these, branching at the American Furnace, is eight miles longer, without any advantage to compensate for the increased distance.

The annexed table shows the leading features of the two main routes, in connection with which most of the alternate lines have been surveyed.

	Length in miles.	Ascent in feet.	Descent in feet.	Estimated cost of graduation.
Clarion route,	140	2195	1515	\$3,555,391
Mahoning and Red Bank route,	133½	1827	1185	2,565,224
Difference,	6½	268	330	\$990,167

There would be 6,400 feet aggregate length of tunnels on the Clarion route, if the grade be kept at the limit of 52 $\frac{8}{10}$ feet per mile, and 4,860 feet aggregate length of tunnels on the Mahoning and Red Bank route. On the latter, only one tunnel occurs on a dividing ground; the others are introduced in cutting off the bends of Mahoning. There are also 976 degrees more curvature on the Clarion than on the Mahoning and Red Bank line.

The following are the lengths of the four principal routes, to which particular reference has been made.

	From Kittanning.	From Pittsburgh.
Cowanshannoc, - - -	148 miles.	191 miles.
Mahoning and Red Bank, -	133½ "	176½ "
Red Bank and Corsica, -	135½ "	178½ "
Clarion, - - - -	140 "	183 "
From Pittsburgh to Kittanning 43 miles.		

Should the revised line along Potato creek and (upper) Allegheny river be approved of, and finally selected, it will add about $1\frac{1}{4}$ miles to each route.

As soon as a route is adopted, and the line finally located, a carefully revised estimate will be made on the entire route, based on the contract prices. In the meanwhile, it may be sufficient to state, that it will not probably vary materially from estimates previously returned, based on the route via Mahoning and Red Bank. I cannot regard this report as complete without a still more detailed account of this route, herewith annexed.

Topographical description of the Mahoning and Red Bank route, from Kittanning to the State line, a distance of $133\frac{1}{2}$ miles.

Beginning at the crossing of Market and Back streets, at an elevation of 44 feet above low water of the Allegheny river, at Kittanning, the line runs across the favorable river bottoms and along the bank of the river to the mouth of Mahoning, 10 miles, crossing the Cowanshannoc on the third, and Pine creek on the fifth mile. The curves on this portion are described generally with radii more than half a mile long, the minimum being 1432 feet. The grades are light, the maximum being $26\frac{4}{10}$ feet per mile, ascending with the river, and $10\frac{5}{10}$ feet per mile descending. Immediately below the mouth of Mahoning, the line curves round the point of the hill and passes into the Mahoning valley, crossing the stream at a short distance up, and passing through a projection, or bend, by a tunnel 910 feet in length. It continues on the right bank of the Mahoning, on the maximum ascending grade of $52\frac{8}{10}$ feet per mile, (reduced on curves,) for about eight miles, to Lavelly's summit, which divides the waters of Mahoning and Red Bank. In attaining this summit the line ascends 328 feet, being an average of $41\frac{1}{2}$ feet per mile. On the sixth mile there are two tunnels, through spurs of the side hill, of 930 and 1235 feet, respectively; and on the seventeenth mile, one of 495 feet in length. Lavelly's summit, on the nineteenth mile, is passed by a tunnel 1290 feet long. These are all the tunnels which occur on the entire route, comprising an aggregate length of 4860 feet. These seven miles embrace a heavy fill at Powell's run, on the fourteenth mile, and another at Raynor's run, on the fifteenth mile.

After leaving the tunnel at Lavelly's summit, the line is traced along the left bank of the big bend of Red Bank, on a descending

grade, to its crossing of the stream, at New Bethlehem, on the twenty-third mile, at an elevation of 34 feet above its bed. The descent from Lavelly's summit to New Bethlehem is 87 feet, being at the average rate of 22 feet per mile, on a distance of 4 miles. In passing from the Mahoning to the Red bank by this short cut, the line is shortened 13 miles, as compared with the route passing up the Allegheny to the mouth of Red Bank, and up the valley of the latter to New Bethlehem; while the ascent of the river and stream to New Bethlehem enables us to maintain the grade, at a low crossing, within 87 feet of the height at Lavelly's summit. The bridge at New Bethlehem crosses at a favorable site, with two spans of 100 feet each.

From New Bethlehem the line is traced along the bottom lands on the right bank of Red Bank valley, over very favorable ground, with moderate excavations and embankments, and easy grades, in no case exceeding $26\frac{4}{10}$ feet per mile, for eleven miles, where it crosses the stream near Heathville. It cuts off the horse shoe bend, on the twenty-third mile, saving $1\frac{1}{2}$ miles of distance. The grade at the crossing of the stream is 38 feet above its bed, giving a cutting of 32 feet on one side and 38 feet for a short distance on the opposite side. Thence the line follows the left bank of Red Bank, passing Troy on the thirty-sixth mile, over very favorable ground, with easy work and light grades, to the thirty-eighth mile, when it crosses the stream, on a bridge of two spans, at Robinson's bend, by a cut-off, saving a little over one mile of distance. The grade at this crossing is 49 feet above the bed of the stream, and there is a cut about 900 feet long, averaging nearly 50 feet deep.

Thence the line continues on the right bank, passing Dowlingsburg, on the thirty-ninth mile, to Brookville, the county seat of Jefferson, on the forty-fourth mile, at the junction of Sandy Lick and the North fork of Red Bank, which is crossed by a bridge of two spans, of 75 feet each, at an elevation of 38 feet above the bed. From Bethlehem to this point, a distance of 22 miles, the work is quite moderate, with the exception of the two crossing points mentioned; and the highest gradient employed is $26\frac{4}{10}$ feet per mile. The total rise in this distance is 163 feet, being an average of $7\frac{1}{2}$ feet per mile. The line then follows the left bank of the North fork over favorable ground, except at the forty-ninth mile, where a considerable embankment occurs at Moore's

run and a culvert of 8 feet span; and at the fiftieth mile, where a similar embankment and a culvert of 20 feet span are necessary to pass the Pekin branch of Russell's run. The high ground near Richardsville, on the fifty-second mile, is passed by a cut 24 feet deep, containing 60,000 cubic yards.

The maximum grade used on this cut-off route, near Richardsville, is $47\frac{52}{100}$ feet per mile on straight lines, thereby saving about two miles of distance. The total rise from Brookville being 313 feet, on a distance of a little over 8 miles, shows an average ascent of $39\frac{2}{10}$ feet per mile. The grade line at this point is 734 feet above the starting point at Kittanning.

From Richardsville, the line descends gradually to the immediate valley of the North fork, continuing on the right bank to its crossing on the fifty-sixth mile by a bridge of forty feet span. Seneca run, on the fifty-fifth mile, is crossed by a culvert of ten feet span. Thence the line continues in the valley, crossing the North fork twice on the fifty-ninth mile, with bridges of thirty feet span; twice on the sixtieth mile, with bridges of twenty-five feet span; and once on the sixty-first mile, with twenty feet span. It attains the dividing ground between the North fork and Clarion on the sixty-second mile, at an elevation of eight hundred and forty feet above grade at Kittanning. The total rise from Richardsville is one hundred and four feet, or $10\frac{4}{10}$ feet per mile. The grades and curves are gentle, and the work moderate, on this distance of ten miles.

The line then passes over the head waters of Maxwell's run, on the beginning of the sixty-third mile, with a culvert of twelve feet span, and an embankment fifty feet high, averaging twenty-five feet on a length of eight hundred feet. On the sixty-fourth mile, it passes the dividing ground between Hunting Camp run and Beech Bottom run, waters of the Clarion, at an elevation of eight hundred and sixty-eight feet above the grade at Kittanning; the highest gradient on this part being forty-seven and a half feet per mile, reduced on curves. Thence the line follows the valley of Beech Bottom to the valley of the Clarion, with moderate cutting and filling, to the sixty-seventh mile, where it crosses Maddock's run on an embankment and a culvert of ten feet span. Thence it is traced along the side hill on the left bank of Clarion to the mouth of Little Toby on the seventieth mile, which is crossed on a bridge of two spans of seventy-five feet each, at an

elevation of forty-eight feet above the bed of the stream. The grade at this crossing is five hundred and ninety-seven feet above Kittanning, showing a descent of two hundred and seventy-one feet on a distance of six miles, averaging forty-five feet per mile.

The line then continues along the left bank of Clarion, with moderate side-hill work and occasional bottom. On the seventy-third mile it is proposed to change the channel of the stream at the sharp bend below the "Boston Mill," which can be effected at moderate cost; and on the seventy-fifth mile, at another bend at the entrance of Island run, a similar arrangement is proposed. The line is thus kept on the left bank of the Clarion on very easy grades to the bend just below Dickinson's mill, near Ridgway, where it crosses the river by a bridge of two spans of one hundred feet each, and enters Ridgway, the county seat of Elk, on the seventy-eighth mile. The grade at this place is 624 feet above the starting point at Kittanning. The total rise of grade from the mouth of Little Toby to Ridgway is twenty-five feet in seven miles, or about three and a-half feet per mile.

From Ridgway, the line continues on the right bank of Clarion, with very light grades and easy work, to the 84th mile, where it crosses the river on an island, with two spans of 100 feet each, at an elevation of 21 feet above the bed. Thence the line follows the left bank, with very light grades and moderate work, to near the upper end of mile 86, opposite Johnsonburg, at the junction of the East and West forks of Clarion, crossing the East branch to its right bank just above Johnsonburg, by a bridge of 100 feet span, 18 feet above its bed, at the beginning of the 87th mile. The height of grade is 680 feet above Kittanning, and 58 feet above Ridgway,—showing an ascent of $6\frac{1}{2}$ feet per mile on 9 miles.

The line then continues in the valley of the East branch of Clarion, with very slight grades and moderate work, for 7 miles, to the 94th mile, crossing the stream twice on the route, with bridges of 80 feet span, and Crooked creek with a bridge of 25 feet span. The elevation above Kittanning on the 94th mile, is 795 feet, and rise from Johnsonburg 116 feet in 7 miles, being at the rate of nearly 17 feet per mile. Thence the line is traced along the right bank of the stream to its source. The work continues of a light character to mile 97th, at the crossing of Seven Mile run, where a heavy embankment and a culvert of 18 feet

span are unavoidable. The total rise in these three miles is 82 feet, or about 27 feet per mile. From Seven Mile run, the line continues in moderate side-hill work to the 100th mile, at the crossing of Smith's brook, where a heavy embankment and a culvert of 8 feet span are required. Thence to the beginning of mile 104th the line is in moderate side-hill cutting and filling. A deep cut commences about the middle of the 104th mile, which increases gradually to 26 feet at the end of the mile, and extends into the 105th mile, on Bishop's summit, running out near the middle of the mile. The greatest depth of cutting is 38 feet, and the total quantity estimated in the entire cut is 119,160 cubic yards.

The highest point of grade at Bishop's summit, 104½ miles, is 1298 feet above low water at Kittanning. The rise in the last 10½ miles is 537 feet, or at the average rate of 50½ feet per mile. This is our main summit, near the town of Teutonia, which stands at the north end of the cut.

From Bishop's summit, the line descends with the maximum grade of 52½ feet per mile along the left bank of Red Mill brook, with tolerably heavy cutting and filling, crossing Woodruff's and Little Rock runs with heavy fills, but with only double drains for the passage of the water, and Big Hollow run, requiring a culvert of 8 feet span. In a final location, the line can be modified and the embankments reduced at these points.

On the 111th mile, the line cuts through a spur on the side-hill, and passes to the valley of Potato creek, opposite the mouth of Red Mill brook, the work continuing tolerably heavy to mile 113th, at Robin's run, where a culvert of twelve feet span, and a deep fill are encountered. It may be somewhat improved on a final location. The line continues along the side-hill, crossing Smith's run at the end of the 114th mile, by a considerable embankment, and a culvert of 8 feet span, to mile 116th, in the valley of Potato creek, where it crosses the stream on a bridge of 60 feet span, 18 feet above its bed. Here we have command of the level and favorable valley of Potato creek.

The distance from Bishop's summit to this point is 11½ miles, and the total descent 579 feet, showing an average grade of 49 feet per mile. This is the highest and longest grade on the road, on which the minimum radius of curvature at the difficult points is reduced to about 1000 feet. The line as originally

traced down Potato creek, and along the valley of the Allegheny to the State line, on the 134th mile, contains several ascending grades encountered in saving distance by cut-off routes. A revised line has since been carefully run, which is found to present the following characteristics: It has no ascending grade northward; the maximum descending grade is $10\frac{5.6}{100}$ feet per mile, and the average grade on a distance of $18\frac{3}{4}$ miles is only about $2\frac{1}{8}$ feet per mile. The minimum radius of curvature, which occurs in a single instance only, is 1432 feet. A radius of 1910 feet is used in but three places; 2292 feet twice; all the other curves have radii of 2865 or 5730 feet. A large portion of the distance is straight. Some saving in first cost could be effected by introducing undulating grades, but the work on this part of the line, on an average, is very moderate, and I regard it as highly important to maintain the north-eastern end of the road in the best possible shape for the transportation of an immense coal business, for the supply of Western New York, including the populous cities of Buffalo and Rochester, and for consumption and shipment on lakes Erie and Ontario, with both of which this line will be in direct rail road connection; affording also, the cheapest and most convenient communication with the flourishing region of Canada West, now containing more than a million of inhabitants.

The same principle, of avoiding ascending grades in the direction of this coal trade, is to be continued on the Corning and Olean road, through which a junction is to be effected with the New York and Erie road and Genessee Valley canal at Olean; so that the limit of capacity of a locomotive from the coal region to Olean will be the number of empty cars it can carry up an ascending grade of $52\frac{8}{100}$ feet per mile. But this does not show the entire advantage of the proposed arrangement of the grades. The distance from Bishop's summit to Olean will be about 40 miles, and on 28 continuous miles of this, there will be no ascending grade; the limit of capacity on which, will be the amount of tonnage a locomotive can draw on a level.

With these views, should this general route be adopted, I would recommend the revised line along the Potato creek and Allegheny valleys, although it will add about $1\frac{1}{4}$ miles to the length of the road, and make the entire distance from Kittanning to the New York State line about $134\frac{1}{4}$ miles.

On an examination of the prominent characteristics of this route, it will be observed that there are comparatively few miles or sections of very heavy work, namely: six between the Mahoning and Red Bank, and seven between Bishop's summit and Smethport. There are but ten others, occurring at intervals between New Bethlehem and Bishop's summit, which can be regarded as heavy work. With these exceptions, the entire route is remarkably favorable for the construction of a first class rail road, with generally moderate curves, and very easy grades. The maximum grade of $52\frac{8}{10}$ feet per mile, is only used in three instances: in ascending from the Mahoning to Lavelly's summit, 7 miles; in ascending the east branch of Clarion, 10 miles, to its head at Bishop's summit, and in descending thence along the Red Mill brook to Potato creek valley, $11\frac{1}{2}$ miles; and on all the curves, it is reduced not less than $\frac{2}{100}$ feet per station of 100 feet for each degree of deflection from a straight line.

It has other features worthy of special attention, taken in connection with the division between Pittsburgh and Kittanning (43 miles.) On 53 consecutive miles from Pittsburgh to the mouth of the Mahoning, there is no ascending grade exceeding $26\frac{4}{10}$ feet per mile, no descending grade over $10\frac{5.6}{100}$ feet per mile, and no curve with a shorter radius than 1432 feet. On $25\frac{1}{2}$ consecutive miles in the valley of Red Bank, there are no grades exceeding $26\frac{4}{10}$ feet per mile. On 23 consecutive miles in the valley of Clarion, there are no grades exceeding $26\frac{4}{10}$ feet per mile; and on 18 consecutive miles extending along Potato creek and the (upper) Allegheny river to the New York State line, there is no ascending grade at all, and no descending grade exceeding $10\frac{5.6}{100}$ feet per mile. Thus making $121\frac{1}{2}$ miles, in four sections, each continuous, on which the maximum grade employed is $26\frac{4}{10}$ feet per mile.

From Bishop's summit to the State line, 30 miles, where the heavy coal trade of Western New York and the lakes will cause a preponderance of tonnage northward, the line is all descending or level; and at the Pittsburgh end on a distance of 62 consecutive miles, where the iron, coal and lumber, from Clarion, Armstrong, Jefferson, and other counties, will yield a heavy tonnage towards the Pittsburgh and river markets, the line is so arranged as to have no ascending grade against this trade exceeding $10\frac{5.6}{100}$ feet per mile.

The profile of the New York and Erie, Pennsylvania Central, Baltimore and Ohio, or Virginia Central rail road, will not present features at all comparable with the line of the Allegheny Valley road; whilst the latter will be much cheaper per mile than either of the others. These valuable characteristics of your route, cannot fail to have an important bearing, not only on the amount of traffic your road must command, but on the proportion of profit to be derived from its transportation. The line can be advantageously divided into convenient sections for running the road in the most economical manner, and there is no spot on the entire route, where trains may not safely pass at the rate of forty miles an hour.

Regarding it as a main trunk road, which it assuredly is, connecting the extensive net-work of New York improvements by the nearest and best practicable route with the navigable waters of the Ohio and Mississippi, and, by chains of roads through Ohio already far advanced towards completion, extending that connection by rail road from Pittsburgh to Cincinnati, on the most direct route, and to St. Louis, and the fertile States of the south-west, its estimated cost (certainly under \$30,000 per mile,) must seem very moderate when compared with the magnitude of the results which may fairly be anticipated from its completion.

You are acquainted personally with the route, and therefore know that a large portion of it passes through, and in such a manner as to control, a fine agricultural region, even now abounding in the profitable elements of rail road business, and capable of furnishing a large agricultural surplus. The counties in Pennsylvania that will be tributary to it, contained, according to the census of 1850, a population of 363,000; whilst the five counties of Western New York directly interested in connecting with this line, and which are now actively engaged in building three distinct rail roads to unite with it, contained at the same period a population of 523,000. In three years, or about the contract time for completing your road, the combined population in the counties mentioned, in the two States, will not be less than 1,300,000.

The opinion which has been promulgated, that this road is in advance of the wants of the country, is entirely erroneous. The Bellefontaine and Indiana road, in Ohio, which has been opened

within a few weeks, with its stock ten per cent. above par, has a larger proportion of unimproved land upon its borders, and a much smaller local population, without any important town upon its route or at either end; whilst the Allegheny Valley line presents direct and convenient connections between the important cities of Pittsburgh, Buffalo and Rochester, containing an aggregate population at this time of over 200,000. It is well known that it passes through the finest iron region in the State, which also abounds in coal and limestone of the best quality. It will also form an outlet for an immense amount of pine and cherry lumber of the most superior quality, the demand for which is annually increasing.

But I will not attempt to portray in detail what may be termed the great natural advantages of this line; most of these have already been ably described in the pamphlet prepared by yourself in 1852. There is one striking feature in connection with your road which should not be overlooked, furnishing as it does the strongest security for a large *local* business, which eventually must become on all our great lines the chief source of profit; it is this—that there is a larger local population on the first sixty miles of the Allegheny Valley Rail Road, than the same distance on any other route leading from Pittsburgh.

The opening of continuous rail roads from Boston, Albany and New York, by way of the Allegheny Valley Rail Road to Pittsburgh, will constitute an important era in the business history of this city, which cannot now be fully appreciated.

With such a route, and with such connections as the position of your line places at your command, you have the strongest inducements to push forward this great public improvement with the utmost vigor; and, from the well known character and ability of Messrs. Chamberlains, Leech & Co. who have the contract for doing the entire work,—except furnishing iron,—there is every reason to expect that it will be completed during the season of 1856, as provided in the contract. They are required to open it for use between Pittsburgh and Kittanning (and this may easily be extended to the mouth of Mahoning,) early in the fall of next year; and, if the iron be promptly furnished, the Board may anticipate a compliance with this stipulation.

The few general remarks introduced will not, I trust, be considered altogether irrelevant to the subject of *Surveys*—which I

take great pleasure in stating, have been conducted with admirable skill and perseverance, by my excellent Associate Engineer, GEORGE R. EICHBAUM, and Messrs. ROBERT W. CLARKE, J. S. LAWRENCE, FRANKLIN WRIGHT and CHARLES M. BOYLE, Principal Assistant Engineers, and their assistants, aided by J. J. SIEBENECK, our efficient Draughtsman. Messrs. Clarke and Lawrence are now in the service of other companies. Messrs. Wright and Boyle are engaged with two full parties in revising lines preparatory to final locations.

The work of construction on the division between Pittsburgh and Kittanning is in active progress, under the immediate charge of Captain T. J. BRERETON and Mr. JAMES C. NOON, Assistant Engineers, and Mr. JAMES MORLEY, Junior Assistant. It is arranged in three sub-divisions.

To all of the gentlemen connected with the Engineer Department, I beg leave to offer my sincere thanks, for the uniformly faithful and courteous manner in which they have performed their respective duties.

All of which is respectfully submitted.

W. MILNOR ROBERTS,
Chief Engineer.

OFFICE ALLEGHENY VALLEY RAIL ROAD Co. }
Engineer Department, }
Pittsburgh, July 25th, 1853.

MINUTES OF THE BOARD OF MANAGERS.

At a meeting of the Board of Managers of the Allegheny Valley Rail Road Company, held on the 27th of July, 1853, the following preamble and resolutions were adopted:

WHEREAS, The maps, profiles and estimates made under the direction of the Chief Engineer, Mr. ROBERTS, of the several routes surveyed for the Allegheny Valley Rail Road northeast of Kittanning, as exhibited by him, together with his report upon the same, are entirely satisfactory; Therefore,

Resolved, That after due examination of the whole subject, the route from Kittanning, *via* Mahoning, Red Bank and East branch of the Clarion river, to Bishop's Summit, and thence by the way of Potato creek to the most eligible points on the New York State line, be and the same is hereby adopted as the line of said Allegheny Valley Rail Road.

Resolved, That the Chief Engineer be authorized and requested to locate and prepare the line for work forthwith, according to the route this day determined upon.

Resolved, That the Chief Engineer be requested to prepare his report, together with a map of the various lines surveyed, for publication.

TABLE OF DISTANCES

Along the Allegheny Valley Rail Road, on the adopted route:

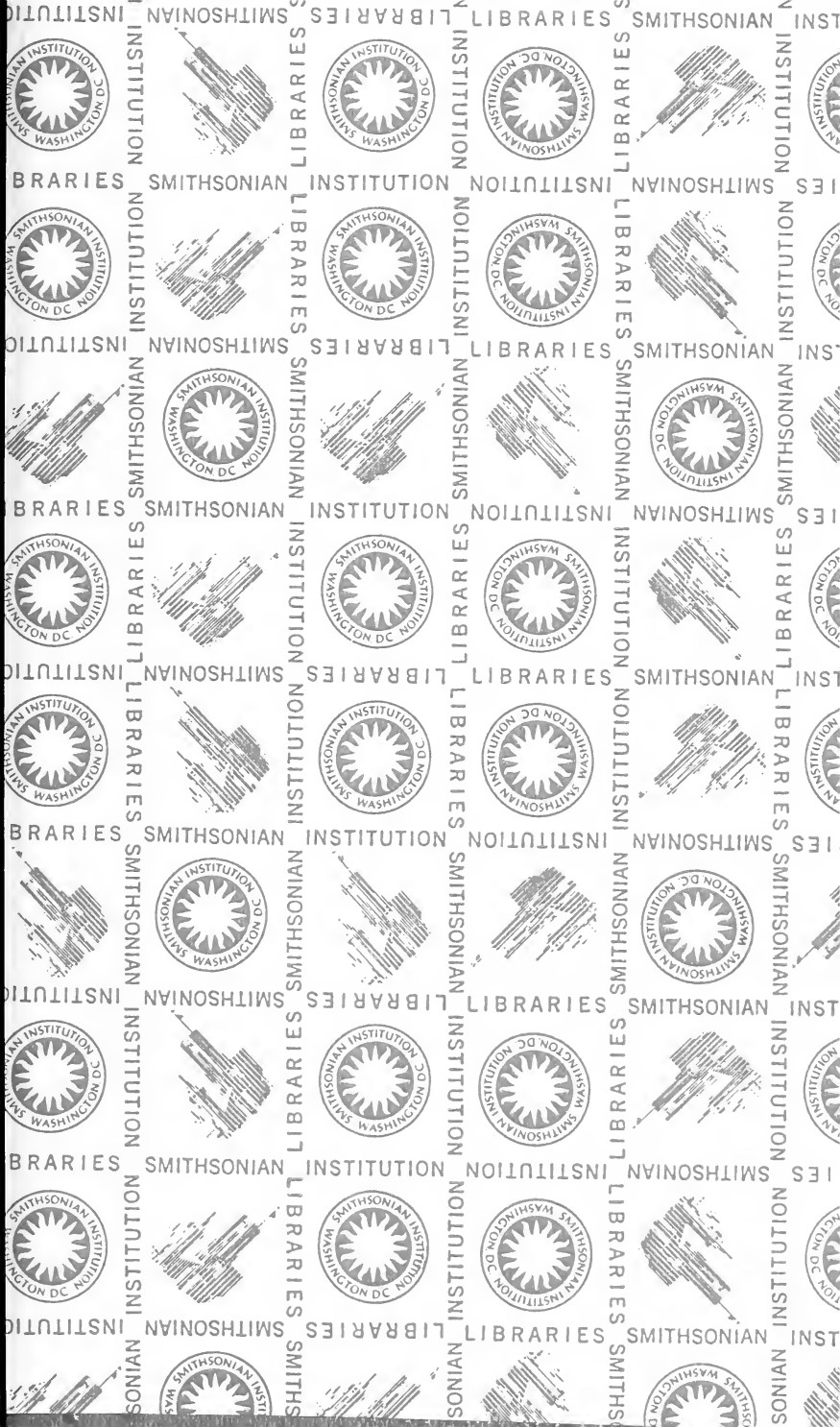
FROM PITTSBURGH TO							
MILES.				MILES.			
Sharpsburg,	-	-	4	New Bethlehem,	-	-	66
Deer Creek,	-	-	13	Heathville,	-	-	77
Tarentum,	-	-	21	Troy,	-	-	80
<i>Freeport</i> ,	-	-	27	Brookville,	-	-	88
Kiskiminitis River,	-	-	29	Mouth of Little Toby,	-	-	113
Clinton,	-	-	33	Ridgway,	-	-	121
Crooked Creek,	-	-	38	Johnsonburg,	-	-	129
Kittanning,	-	-	43	Bishop's Summit,	-	-	147
Mouth of Mahoning,	-	-	53	Smethport,	-	-	160
Lavelly's Summit,	-	-	61	State Line,	-	-	177











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Report on the surveys of the Allegheny V